ELSEVIER

Nuclear Instruments and Methods in Physics Research B 150 (1999) xiii-xviii

NIM B
Beam Interactions with Materials & Atoms

Contents

Editorial vii

Committees and Sponsors viii

Conference Photograph x

I. Physical Processes and X-ray Production

PIXE and PIXE-induced XRF for chemical specification
M. Uda and T. Yamamoto 1

Energy systematics of the $K\alpha L^f$ satellite transitions
I. Török, T. Papp and S. Raman 8

Deviations of the K_β/K_γ intensity ratio of Ti upon impact with low velocity ions
W.E. Wijsman and R.D. Vis 14

L-shell ionization of Cd, Sb, Te, Ba, La, Eu, Tb and Yb by ^{16}O ions in the energy range from 0.19 to 0.75 MeV u^{-1}
I. Bogdanović, T. Tadić, M. Jakšić, Z. Halabuka and D. Trautmann 18

Charge state dependence of L-shell X-ray production cross sections of $_{28}$Ni, $_{29}$Cu, $_{30}$Zn, $_{31}$Ga and $_{32}$Ge by 12 MeV $^{16}O^{q+}$ ions
Y.C. Yu, A.R. Azordegan, H.L. Sun, J.L. Duggan, F.D. McDaniel, E.K. Lin, C.W. Wang and G. Lapicki 27

M-shell X-ray production cross sections for PIXE applications
M. Pajek, M. Jaskóła, T. Czyżewski, L. Głowacka, D. Banaś, J. Braziewicz, W. Kretschmer, G. Lapicki and D. Trautmann 33

Parametrization of the total photon mass attenuation coefficients for photon energies between 100 eV and 1000 MeV
I. Orlić, I. Bogdanović, S. Zhou and J.L. Sanchez 40

Observation of the evanescent wave excited by proton beam
V.P. Petukhov 46

Intensity estimation of He^+-ion-induced F Kα doubly ionized X-ray satellites emitted from alkali and alkaline-earth fluorides
M. Uda, T. Yamamoto, T. Takenaga, M. Mochizuki and T. Mukoyama 50

Theoretical prediction of S Kβ fine structures in PIXE-induced XRF spectra
M. Uda, T. Yamamoto and T. Tatebayashi 55

Theoretical intensity distribution analysis of Kα satellites emitted from Al, Cl and K
T. Yamamoto, A. Kanai, K. Hayashi and M. Uda 60

Quasi-molecular orbital calculation using the DV-Xα method in Ne–Ne collisions
T. Yamamoto and M. Uda 66

II. Experimental Procedures

Time-resolved pile-up compensation in PIXE analysis with list-mode collected data
K.A. Sjöland, F. Munnik, C. Chaves and U. Wätjen 69

0168-583X/99/$ – see front matter © 1999 Elsevier Science B.V. All rights reserved.

PIXE spectrum analysis taking into account bremsstrahlung spectra
K. Murozono, K. Ishii, H. Yamazaki, S. Matsuyama and S. Iwasaki 76
Virtual PIXE and RBS laboratory
I. Orlic, S. Zhou, J.L. Sanchez, F. Watt and S.M Tang 83
A new analysis chamber with a rotating target holder for total-sample PIXE analysis of aerosol deposits collected in Berner impactors
H. Halder, N. Menzel, B. Hietel and K. Wittmaack 90
A spray technique for preparing uniform large-area PIXE calibration standards from aqueous solutions
N. Menzel, B. Hietel, M. Leirer, W. Szymczak and K. Wittmaack 96
High-resolution PIXE instrumentation survey. Part II
V.P. Petukhov, M. Terasawa and I. Török 103
WDX-PIXE analysis of low energy X-rays using a microbeam
Y. Mokuno, Y. Horino, T. Tadic, M. Terasawa, A. Kinomura, A. Chayahara and N. Tsubouchi 109
Charge integration in external-beam PIXE
J.-O. Lill 114
High-energy PIXE using 68 MeV protons
A. Denker and K.H. Maier 118
Chemical shift measurements of PIXE spectra using a position-sensitive crystal spectrometer
K. Maeda, A. Tonomura, H. Hamanaka and K. Hasegawa 124
Bayesian PIXE background subtraction
J. Padayachee, V. Prozesky, W. von der Linden, M.S. Nkwinika and V. Dose 129
Vaporisation characteristics and detection limits of ion beam thermography
B. Mentes, G. Papaspiropoulos and B.G. Martinsson 136
Dual detector system for PIXE measurement covering a wide element range
K. Kobayashi, Y. Koizumi, C. Nakano, S. Hatori and Y. Sunohara 144

III. Applications of PIXE to Biomedical Samples

Biomedical applications of particle probes and X-ray analysis
B. Forslind 150
The two inverse pathways: the apoptosis and the multinucleated cell switched by the magnesium/zinc balance in irradiated Sarcoma in vivo
S. Harada, K. Sera, S. Futatsugawa, T. Yanagisawa, T. Takahashi and Y. Tamakawa 158
Nuclear microscopy in Alzheimer's disease
J. Makjanic and F. Watt 167
3D mapping of individual cells using a proton microbeam
C. Michelet and Ph. Moretto 173
Single cell elemental analysis using nuclear microscopy
M.Q. Ren, P.S.P. Thong, U. Kara and F. Watt 179
Biological monitoring of toxic metals – steel workers respiratory health survey
T. Pinheiro, A. Bugalho de Almeida, L. Alves, M.C. Freitas, D. Moniz, E. Alvarez, P. Monteiro and M. Reis 185
Trace element load in cancer and normal lung tissue
A. Kubala-Kukuś, J. Braziewicz, D. Banaś, U. Majewska, S. Góźdź and A. Urbaniak 193
Subcellular trace element distribution in *Geosiphon pyriforme*
M. Maetz, A. Schüßler, A. Wallianos and K. Traxel 200
Brain trace elements and aging
G. Hebbrecht, W. Maenhaut and J. De Reuck 208
Changes in trace elements of cerebrospinal fluid after subarachnoid hemorrhage, and effects of trace elements on vasospasm
N. Sato, K. Kuroda, M. Suzuki, A. Ogawa and K. Sera 214

Trace elements in sera from patients with renal disease
Y. Miura, K. Nakai, K. Sera and M. Sato 218
PIXE analysis of Zn enzymes
C. Solís, A. Oliver, E. Andrade, J.L. Ruvalcaba-Sil, I. Romero and H. Celis 222
Quantitative analysis of untreated bio-samples
K. Sera, S. Futatsugawa and K. Matsuda 226
Thick-target PIXE analysis of chromium, copper and arsenic impregnated lumber
K-E. Saarela, L. Harju, J-O. Lill, J. Rajander, A. Lindroos and S-J. Heselius 234
Chronological studies of tree-rings from the Amazon Basin using thick target PIXE and proton backscattering analysis
J. Vanderlei Martins, P. Artaxo, E.S.B. Ferraz and M.H. Tabacniks 240
Analysis of lichen thin sections by PIXE and STIM using a proton microprobe
B.M. Clark, N.F. Mangelson, L.L. St. Clair, J.S. Gardner, L.S. Cooper, L.B. Rees, P.G. Grant and G.S. Bench 248
Some aspects of statistical distribution of trace element concentrations in biomedical samples
U. Majewska, J. Braziewicz, D. Banaś, A. Kubala-Kukuś, S. Góźdź, M. Pajek, M. Zadrożna, M. Jaskóla and T. Czyżewski 254

IV. Applications of PIXE to Marine Samples

Micro-PIXE studies of char populations in northern Canada
J.L. Campbell, J.A. Babaluk, N.M. Halden, A.H. Kristofferson, J.A. Maxwell, S.R. Mejia, J.D. Reist and W.J. Teesdale 260
PIXE analysis of trace elements in northern fur seal teeth
N. Arai, Y. Mitani, W. Sakamoto, K. Yoshida, Y. Mokuno and N. Baba 267
Application of micro-PIXE to fish life history analyses: trace element analysis of otoliths
M. Elfman, K.E. Limburg, P. Kristiansson, K. Malmqvist and J. Pallon 272
Trace metal distribution studies in river water by PIXE
V.J. Kennedy, A. Augusthy, K.M. Varier, P. Magudapathy, S. Panchapakesan, V. Vijayan and K.G.M. Nair 277
Micro-PIXE mapping of sodium and chlorine in selected seagrasses
W.J. Przybylowicz, C.A. Pineda, A.D. Barnabas and J. Mesjasz-Przybylowicz 282
Elemental depth profiles in marine sediments of Singapore coastal waters
I. Orlić and S.M. Tang 291
Trace elements in lake sediments measured by the PIXE technique
L.V. Gatti, A.A. Mozeto and P. Artaxo 298
Pollution assessment in the Trancão river basin (Portugal) by PIXE, EDXRF and isotopic analysis
T. Pinheiro, M.F. Araújo, P.M. Carreira, P. Valério, D. Nunes and L.C. Alves 306

V. Applications of PIXE in Environmental Studies

Analysis of atmospheric aerosols by PIXE: the importance of real time and complementary measurements
P. Artaxo, A.D. Castanho, M.A. Yamasoe, J. Vanderlei Martins and K.M. Longo 312
Source–receptor relationships for heavy metals in the European atmosphere
E. Swietlicki, K. Kemp, P. Wåhlin, J. Bartnicki, L. Jalkanen and R. Krejci 322
Detection of non-sea salt sulphate aerosol at a remote coastal site in South Africa: A PIXE study
P. Formenti, S.J. Piketh and H.J. Annegarn 332
Composition of urban and rural aerosol samples collected in the Great Hungarian Plain
I. Borbély-Kiss, Zs. Kertész, E. Koltay, Gy. Szabó and K. Tar 339
Size-fractionated aerosol composition during an intensive 1997 summer field campaign in northern Finland
W. Maenhaut, J.-L. Jaffrezo, R.E. Hillamo, T. Mäkelä and V.-M. Kerminen 345

Industrial aerosol characterisation at a remote site in South Africa
S.J. Piketh, P. Formenti, H.J. Annegarn and P.D. Tyson 350
A high sensitivity elemental analysis methodology for upper tropospheric aerosol
G. Papaspiropoulos, B. Mentes, P. Kristiansson and B.G. Martinsson 356
Manganese survey in airborne particulate matter from a mining area at Hidalgo State, Mexico
F. Aldape, B. Hernández-Méndez and J. Flores M 363
Hourly measurement of particulate concentrations with streaker samplers and optical methods
E. Filippi, P. Prati, A. Zucchiatti, F. Lucarelli, V. Ariola and P. Corvisiero 370
Characterization of individual aerosol particles from the eruption of Lonquimay volcano in Chile
E. Koltay, I. Rajta, J.R. Morales, I. Borbély-Kiss and Á.Z. Kiss 375
Study of aerosols collected in a speleotherapeutic cave situated below Budapest, Hungary
Zs. Kertész, I. Borbély-Kiss and I. Hunyadi 384
Elemental and mineral characterisation of Coastal Antarctic Aerosols in snow using PIXE and SEM-EDAX
G. Ghermandi, P. Laj, M. Capotosto, R. Cecchi and C. Riontino 392
Air quality work at Guelph: GAViM and a traffic tunnel study
Z. Nejedlý, J.L. Campbell, S.N. Rogak, R.M. Hoff and W.J. Teesdale 398
The influence of meteorological parameters on short range transport of aerosols
A. Wróbel, E. Rokita and W. Maenhaut 403
Aerosol composition and source apportionment in Santiago de Chile
P. Artaxo, P. Oyola and R. Martinez 409
In-stack particle size and composition transformations during circulating fluidized bed combustion of willow and forest residue
W. Maenhaut, M.-T. Fernández-Jiménez, T. Lind, E.I. Kauppinen, T. Valmari, G. Sfiris and K. Nilsson 417
Detailed mass size distributions of atmospheric aerosol species in the Negev desert, Israel, during ARACHNE-96
W. Maenhaut, J. Ptasinski and J. Cafmeyer 422
Study of particulate emissions near a steel plant in Genova by continuous sampling and PIXE hourly analysis
P. Prati, P. Putti, A. Zucchiatti, F. Lucarelli and P.A. Mandò 428
PIXE investigation of aerosol composition over the Zambian Copperbelt
S.L. Meter, P. Formenti, S.J. Piketh, H.J. Annegarn and M.A. Kneen 433
PIXE analysis of airborne particulate matter from Monterrey, Mexico. A first survey
F. Aldape, J. Flores M., R.V. Díaz, B. Hernández-Méndez, J.M. Montoya Z., E.E. Blanco, A.F. Fuentes and L.M. Torres-Martínez 439
PIXE analysis of airborne particulate matter from Xalostoc, Mexico: winter to summer comparison
J. Flores M, F. Aldape, R.V. Díaz, B. Hernández-Méndez and R. García G. 445
Elemental composition of size-fractionated urban aerosol collected in Florence, Italy: preliminary results
P. Del Carmine, F. Lucarelli, P.A. Mandò, M. Valerio, P. Prati and A. Zucchiatti 450
Two years of aerosol pollution monitoring in Singapore: a review
I. Orlic, X. Wen, T.H. Ng and S.M. Tang 457
Quantitative analysis of cascade impactor samples – revisited
I. Orlić, S.Y. Chiam, J.L. Sanchez and S.M. Tang 465

VI. Applications of PIXE to Geological and Mineralogical Samples

Micro-PIXE and quantitative cathodoluminescence spectroscopy: Combined high resolution trace element analyses in minerals
D. Habermann, J. Meijer, R.D. Neuser, D.K. Richter, C. Rolfs and A. Stephan 470
Elemental analysis of agricultural soil samples by particle induced X-ray emission (PIXE) technique
P.E. Cruvinel, R.G. Flocchini, P. Artaxo, S. Crestana and P.S.P. Herrmann Jr. 478
Geogas prospecting – an ideal industrial application of PIXE
L. Malmqvist, K. Kristiansson and P. Kristiansson 484

Radioactivity of neutron-irradiated cat's-eye chrysoberyls
S.M. Tang and T.S. Tay 491
Micro-PIXE elemental imaging of pyrites from the Bulawayan-Bubi Greenstone Belt, Zimbabwe
L. Xenophontos, G. Stevens and W.J. Przybylowicz 496
Contrasting distribution of trace elements between representative antimony deposits in southern China
S. Murao, S.H. Sie, X. Hu and G.F. Suter 502
Monitoring of chromium, copper and arsenic in contaminated soils using thick-target PIXE
J. Rajander, L. Harju, J.-O. Lill, K.-E. Saarela, A. Lindroos and S.-J. Heselius 510
The discovery of native iron nuggets in the 250 m.y. old bedded chert of Sasayama section, Japan: provenance estimated by PIXE analysis
S. Miono, Y. Nakayama and K. Hanamoto 516

VII. Combination of PIXE and other Analytical Techniques and Applications in Materials Science

PIXE analysis of high Z complex matrices
G. Demortier 520
On the interpretation of micro-PIXE measurements on a prototype microstructured reference material
U. Wätjen, I. Bársony, G.W. Grime and I. Rajta 532
An industrial SR TXRF facility at ESRF
F. Comin, M. Navizet, P. Mangiagalli and G. Apostolo 538
Micro-PIXE and channeling PIXE analysis of Ag-doped $YBa_2Cu_3O_{7-\delta}$ thin films
T. Osipowicz, X.Y. Xu, C. Yang, W.Z. Zhou, C.K. Ong and F. Watt 543
Characterisation of ferromagnetic magnetic storage media surfaces by complementary particle induced X-ray analysis and time of flight-energy dispersive elastic recoil detection analysis
Y. Zhang, M. Elfman, T. Winzell and H.J. Whitlow 548
PESA as a complementary tool to PIXE at CTU Prague
J. Voltr, J. Král and Z. Nejedlý 554
Homogeneity study of an Fe impurity in unalloyed Zn using PIXE
F. Gamaz, C. Chaves and U. Wätjen 559

VIII. Applications of PIXE in Archaeology and Arts

Microdistribution and composition of usewear polish on prehistoric stone tools
Ž. Šmit, G.W. Grime, S. Petru and I. Rajta 565
Six stirrup handled Moche ceramic vessels from pre-Colombian Peru: a technical study applying PIXE spectrometry
C.P. Swann, S. Caspi and J. Carlson 571
A portable PIXE system for the in situ characterisation of black and red pigments in neolithic, copper age and bronze age pottery
L. Pappalardo 576
PIXE analysis of ancient Chinese Changsha porcelain
E.K. Lin, Y.C. Yu, C.W. Wang, T.Y. Liu, C.M. Wu, K.M. Chen and S.S. Lin 581
Study of the influence of surface roughness in the PIXE analysis of pottery
A. Zucchiatti, P. Prati, F. Lucarelli and P.A. Mandò 586
Characterization of pre-Hispanic pottery from Teotihuacan, Mexico, by a combined PIXE–RBS and XRD analysis
J.L. Ruvalcaba-Sil, M.A. Ontalba Salamanca, L. Manzanilla, J. Miranda, J. Cañetas Ortega and C. López 591
Preliminary report on porcelain in Meissen (Germany) and Arita (Japan)
M. Uda, H. Kanno and T. Mukoyama 597
Characterization of ancient Chinese pottery decorated with a black pigment
M. Uda, K. Akiyoshi and M. Nakamura 601

External-beam PIXE analysis of small sculptures
I. Gyódi, I. Demeter, K. Hollós-Nagy, I. Kovács and Z. Szőkefalvi-Nagy 605
Pollution effects on stone benches of the Eagle Warriors Precinct at the Major Temple, Mexico City
J. Miranda, M.L. Gallardo, D.M. Grimaldi, J.A. Román-Berrelleza, J.L. Ruvalcaba-Sil, M.A. Ontalba Salamanca and J.G. Morales 611
PIXE analysis and fission track dating of obsidian from South American prehispanic cultures (Colombia, Ecuador)
L. Bellot-Gurlet, Th. Calligaro, O. Dorighel, J.-C. Dran, G. Poupeau and J. Salomon 616
Roman mosaic glass: a study of production processes, using PIXE spectrometry
S.J. Fleming and C.P. Swann 622
Trace element fingerprinting of jewellery rubies by external beam PIXE
T. Calligaro, J.-P. Poirot and G. Querré 628
The combined application of PIXE analysis and thermoluminescence (TL) dating for elucidating the origin of iron manufacturing in Japan
N. Hagihara, S. Miono, Z. Chengzhi, Y. Nakayama, K. Hanamoto and S. Manabe 635
PIXE, XRF and GRT for the global investigation of ancient gold artefacts
G. Demortier, Y. Morciaux and D. Dozot 640
PIXE analysis of ancient Indian coins
M. Hajivaliei, M.L. Garg, D.K. Handa, K.L. Govil, T. Kakavand, V. Vijayan, K.P. Singh and I.M. Govil 645
PIXE and RBS as a tool for the analysis of historic copper halfpennies
M.H. Abraham, G.W. Grime, J.P. Northover and C.W. Smith 651
Trace element composition of archaeological bones and post-mortem alteration in the burial environment
I. Reiche, L. Favre-Quattropani, T. Calligaro, J. Salomon, H. Bocherens, L. Charlet and M. Menu 656
Ion beam analysis of ancient Mexican colored teeth from archaeological sites in Mexico City
L. Rodríguez-Fernández, J.L. Ruvalcaba-Sil, M.A. Ontalba-Salamanca, J.A. Román-Berrelleza, M.L. Gallardo, D.M. Grimaldi, O.G. de Lucio and J. Miranda 663
Inorganic constituents of fossil woods from Cenozoic strata around Osaka, Japan
N. Kagemori, S. Futatsugawa and K. Sera 667
Quality indicators for woodwind reed material
S. Glave, J. Pallon, C. Bornman, L.O. Björn, R. Wallén, J. Råstam, P. Kristiansson, M. Elfman and K. Malmqvist 673

IX. Conference Overview

Conference overview
J.L. Campbell 679

Author index 683